

Rediscovery of the Critically Endangered Banggai Crow *Corvus unicolor* on Peleng Island, Indonesia, part 1: ecology

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Received 31 March 2009; final revision accepted 9 May 2010

SUMMARY.—Following searches initiated in 1991, the Critically Endangered Banggai Crow *Corvus unicolor*, a species previously known solely from specimens, was rediscovered in 2004. It has proved to be a primarily a forest bird on Peleng, where a healthy population occurs in the island's montane west, principally at 500–900 m, with another population in the lowlands of the island's central isthmus. Banggai Crow's behaviour and ecology are similar to those of Piping Crow *C. typicus*. Slender-billed Crow *C. enca*, a potential competitor, appears to be segregated by habitat and perhaps altitude. Nest trees were tall forest species including a Bombaceae, a *Calophyllum* sp., a *Canarium* sp. and a *Palaquium* sp. The conservation prospects for Banggai Crow are discussed.

Banggai Crow *Corvus unicolor* was described from two specimens collected by native hunters, at an unspecified locality in the 'Banggai, Sula Islands', Indonesia (Hartert 1919). Subsequently, in November 1991, YM & LP briefly observed a lone bird in montane forest on western Peleng (Indrawan *et al.* 1997), the first indication of its survival in the wild. Assuming a tiny population (based on the lack of recent records) and rates of habitat loss, Banggai Crow was classed as Critically Endangered (BirdLife International 2001, 2005, 2008). Following the species' definite rediscovery in 2004 (Indrawan & Masala 2007, Masala *et al.* 2008, Mallo *et al.* 2010), our main aim became to research its ecology and review its conservation status. Another, apparently smaller, population was discovered two years later by Celebes Bird Club (CBC) in the central isthmus of Peleng (CBC 2006, 2007, 2008, Mallo *et al.* 2010).

Study area and Methods

The general geography and ecology of the Banggai Islands, and the neighbouring Sula Islands, have been described elsewhere (ICBP 1992, Indrawan *et al.* 1993, Davidson *et al.* 1994, Sujatnika *et al.* 1996). The Banggai archipelago, which shares many biogeographic affinities with mainland Sulawesi, is named after the second-largest island (265 km²), but Peleng (at 2,325 km²) is the largest island. The islands are predominantly low-lying, comprised to a large extent of coralline limestone, and vegetated by mosaics of mixed gardens and moist forests at various stages of disturbance. Only western Peleng reaches altitudes in excess of 500 m, with remnants of pre-humid forest ranging from lowland to montane and subalpine; with increasing altitude the forests become less degraded. CBC (2008) found that central and eastern Peleng (which has undulating to hilly terrain) has more topsoil than the western part, supporting lowland forest trees including figs (*Ficus* spp.), as well as *Canarium* spp., *Pigafetta filaris*, *Lithocarpus havilandii*, *L. glutinosus*, *Shorea koordersii*, *Pometia* sp., *Macaranga* spp., *Gnetum gnemon*, *Trema orientalis* and a *Mangifera* sp.

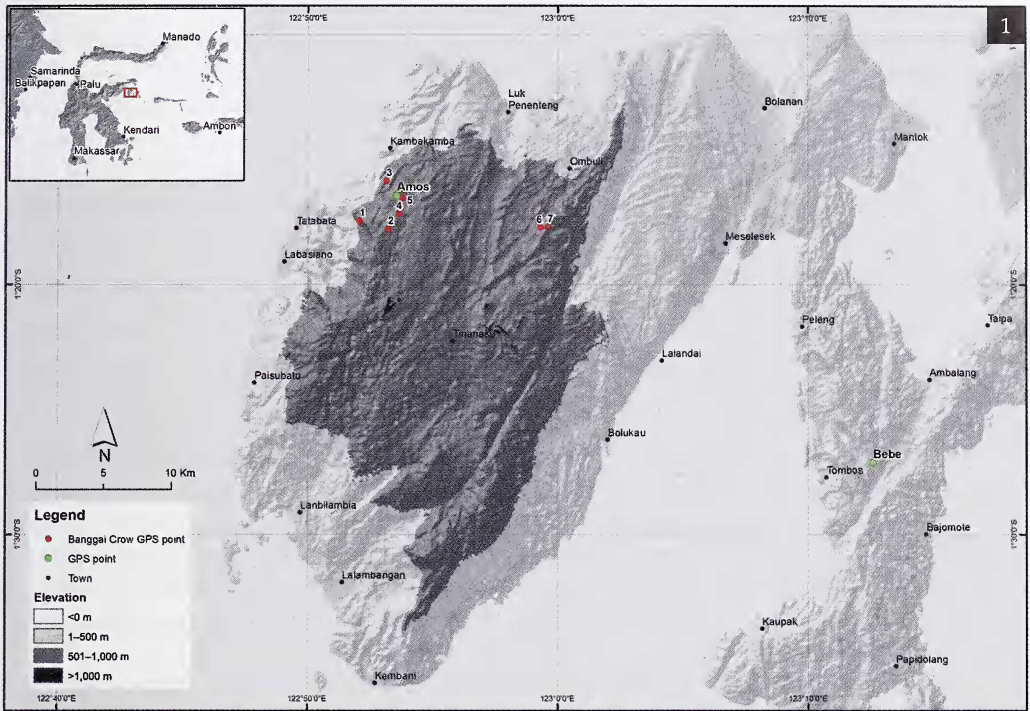


Figure 1. Map of the Banggai Islands, including Peleng (main study localities: two in western Peleng and one in the central isthmus; based on SRTM 90m Shuttle Radar Topographic Mission (Farr *et al.* 2007).

Figure 2. Banggai Crow *Corvus unicolor*, Peleng, Indonesia, 26 January 2008 (Frangky Masala).

Figure 3. Habitat of Banggai Crow *Corvus unicolor*, Peleng, Indonesia (Mochamad Indrawan)

At 800–900 m western Peleng supports typical montane life forms such as lichens, pandans, epiphytes and bryophytes. The forest trees, though not necessarily obligate montane flora, include commercially valuable timber such as a Bombaceae, a *Palaquium*

sp., various oaks (*Lithocarpus* spp.), a *Calophyllum* sp., *Canarium* spp., a *Syzygium* sp. and a *Podocarpus* sp. The forests do not appear to offer much fruit availability. Common fruiting trees included a *Myristica* sp., a *Syzygium* sp. and an unknown tree species.

Slash-and-burn cultivation is practiced, with *ladangs* of yam, taro and legumes.

Climatic data from the nearby mainland c.40 km away (Bubung-Luwuk meteorological station, unpubl. data 1996–2006; M. Sakey pers. comm.) suggest that the wet season generally occupies March to July, with 66–235 mm of rainfall. The dry season, which usually lasts September–November is marked by monthly rainfall of 14–23 mm. Rainfall peaks mainly in June, with a smaller peak in March.

On 2–7 October 2004, 12 September–11 October 2006, and 27 April–17 May 2007 expeditions were mounted to locate the crow, by MI & I. Tinulele (IT); MI, YM, AM & FM; MI, YM, AM, FM & D. S. Katiandagho (DSK), respectively. Available evidence suggested that crows seen in the lowlands in 1981 (Bishop 1992), and subsequently found to be widespread (Indrawan *et al.* 1997) were probably Slender-billed Crows *Corvus enca*, so searches were concentrated mainly at c.500–900 m, especially above Tetendeng, in the montane west of the island (= Peleng Mountains) where a putative Banggai Crow was reported in 1991 (Indrawan *et al.* 1997, Indrawan & Masala 2007). Rapid visits were also made to Alani, at c.400–500 m, in the western Peleng Mountains (7 October 2004), Bombolon, in the eastern Peleng Mountains (01°13'39"S, 123°03'43"E; c.250 m; 11 October 2006), and to the southern Peleng Mountains between Alul and Kramat (01°18'48"S, 123°03'36"E and 01°17'44"S, 122°59'18"E, respectively; 150–900 m; 1–7 May 2007).

Further ecological data were gained during complementary field studies by CBC, conducted mainly on the central peninsula of the island, especially at Bebe (Liang subdistrict, 01°26'69"S, 123°12'36"E; 320 m), on 29 October–2 November 2006, 24 July 2007, and 21–25 March 2008.

Interviews with local farmers and hunters recruited as guides were also conducted to record additional anecdotal data concerning the species.

Field identification and vocalisations

Examination of Banggai Crows in the hand was possible as follows (location, observers and dates in brackets): one dead bird recently shot by two local hunters (YM & FM, Amos, 14 May 2007), two specimens collected with assistance of local people (CBC, Bebe, 16 and 22 August 2007) and deposited at the Museum Zoologicum Bogoriense, Cibinong (MZB); and a bird mist-netted, measured, photographed and released (YM & FM, Supit, 26 January 2008).

Field identification was based on plumage, size, as well as vocalisations and, to a lesser extent, behaviour and ecology. Examination of specimens and photographs revealed that the pale grey, rather large irides, the larger but relatively short bill, and very short wings and tail are also useful identification features (P. C. Rasmussen *in litt.* 2009).

In the field, Banggai Crow appears a small crow with generally slaty black plumage and a dull brown sheen. Compared to Slender-billed Crow, it generally appears more streamlined (and thus smaller), although there is the potential for size overlap between the two. As observed twice in different locations, Banggai Crow when perched can even resemble Common Cicadabird *Coracina tenuirostris* in both shape and posture, though the cicadabird is smaller and has a less heavy bill.

In good light, the mantle to shoulder possesses a dull brown sheen, and once a brownish sheen was also visible on the neck. Unlike Slender-billed Crow, the species lacks any readily visible violet / purplish gloss. Whereas the neck and underparts frequently appear slaty (i.e. dull), the head, throat, breast and abdomen are black, and in good light

there can appear to be a darker facial mask. In the field, it has an apparently dark iris, and black heavy bill, with dark feet and claws. The primaries and trailing edge of the wings are slaty black. The tail is short, and when perched is almost wholly concealed by the folded wings; once, there appeared to be a gap of 1–2 cm between the edges of the folded wings and the tail. These proportions differentiate it from Slender-billed Crow, which according to Goodwin (1976) is relatively longer tailed.

Our observations, especially of the brown tinge on the mantle and the tail proportions matched the species' depiction in Coates & Bishop (1997) quite closely. The quality of the brown sheen matched that of the syntypes at the American Museum of Natural History, New York (photograph courtesy of N. J. Collar), although the brown appeared more extensive and reached the underparts in the latter. The type description mentioned that 'the upperside has a fine purplish-blue, strongest on the wings and crown while the hind-neck, chest, breast, and abdomen (which are white in *G. typica*) are duller and more brownish slaty black' (Rothschild & Hartert 1900). Although the purplish-blue tinge was not readily observed in the field, once a dull blue-greenish tinge was observed to the shoulder. The dull brown sheen was less readily observed in juveniles. In two different individuals, the plumage appeared dark and even to have a slightly bluish sheen.

The flight is swift, whistling and direct, resembling that of Piping Crow *Corvus typicus* (Goodwin 1976). Compared to Slender-billed Crow, Banggai Crow more likely keeps to the canopy and changes perches with a quick, agile manner. Like *C. enca*, the whirring of its wings can be heard when close, albeit less readily so, though it still serves as a good clue for detection in more closed forests. The species is highly active, rarely keeping still and thus appears nervous. Only three times were birds observed on exposed perches for 2–8 minutes, always at distances of 100–300 m.

Prolonged close observations are difficult, as the species is highly wary, especially if approached by observers. However, once a bird circled the observer while making harsh calls, as if mock-attacking an intruder, not unlike a Piping Crow mobbing stationary human observers (IT, 4 October 2004).

Banggai Crow vocalises mainly in the morning, on leaving the roosts, as well as in the afternoons. Calls are uttered both perched and in flight. They are relatively vocal, e.g. on 5 October 2006, at 06.00–07.00 h, two exchanged calls at a rate of up to 8–12 phrases / minute. Bouts may last up to c.20 minutes. Thus, calls are useful for detection.

Birds in a group give a 3–4-note creaking whistle *kruik, kruik, kruik, kruik* (lasting 2–3 seconds), which at close range sounds like nasal screams, and apparently serves as a contact call emitted both in flight and perched, and was termed type 1. Once, type 1 was emitted with the bill opened half its width. The main call also included a whistled double *kriiuk...kruuik*, which lasts c.0.8–1.5 seconds and is apparently given most frequently in flight. Although probably a shortened variation of type 1, it is termed type 2. Birds in threes and fours appear to more readily vocalise than in one or twos, giving type 1 and type 2 calls, respectively. Sometimes, type 1 calls are immediately followed by a melodious whistle, a two-note phrase initially descending then ascending, *whu, weeeeeeee* (lasting 2–3 seconds). This is the type 3 call, and occasionally it was initiated with a single metallic note, *tong*. Variations included strophes of creaking and trilling notes. Juveniles gave a repeated soft cawing *wree-eek* (c.0.8–1.0 second), which may be a contact / alarm call, and is termed type 4.

The whistled main calls and nasal screams of Banggai Crow are not unlike those of Piping Crow (IT pers. obs.; <http://homepage.mac.com/alanwilkinson/birding/sulawesi/grf/pipingcrow.mov>). But, those of Piping Crow are apparently higher pitched, more upslurred, with the last element ascending sharply and perhaps harsher. The type 3 call of

TABLE 1
Sightings of Banggai Crow *Corvus unicolor* in western Peleng in 2004 and 2006. Encounters believed to involve the repeat detection of a previously seen bird are not listed

Date (observer/s in brackets)	Time / duration of sightings	No. of birds	No. of juveniles	Behaviour	Habitat	GPS reference ¹	Location	Notes
03/10/04 & 04/10/04 (IT)	c.15:00 h; 1–2 minutes; two consecutive days	1	none	Moving through spring area	Border of cultivation / secondary forest	1	Kokolomboi (01°17'28.2"S, 122°52'04.5"E), 539 m	Probably the same bird
04/10/04 (MI)	06:10 h; 30 seconds	4	unknown	Flew from roosting area to forested lower slopes of mountain, probably to forage	Border of cultivation / secondary forest	2	Laheme (01°17'47.7"S, 122°53'12.6"E), 844 m	
04/10/04 (MI)	c.08:40 h; 20 seconds	3	1	Foraging at forest edge	Secondary forest		Laheme	
05/10/04 (MI)	05:40 h; 2 minutes	2	unknown	Seen in the canopy of tall isolated roost trees just after sunrise, at a distance of c.200 m	Border of cultivation / secondary forest		Laheme	
05/10/04 (AM & MI)	08:30–10:30 h; 30–60 seconds each group	12 (three groups of four)	2 in each group	Apparently three different pairs with two fledglings each briefly seen in forest	Secondary forest		Laheme	
21/09/06 (YM & FM)	07:15 h; c.10 seconds	1	-	Moving away in heavy mist	Border of cultivation / secondary forest		Kokolomboi	
21/09/06 (YM & FM)	15:45–15:50 h; 2 minutes	4	2	Fed and moved through canopy, 10–20 m above ground	Primary forest		Sabul	
22/09/06 (YM & FM)	10:00 h	-	-				Sabul	Four unoccupied nests
22/09/06 (YM & FM)	08:10 h; c.30 seconds	2	unknown	Moving through canopy, 10–15 m above ground	Secondary forest		Sabul	
22/09/06 (YM & FM)	08:20 h; 30 seconds	2	unknown	Moving through area	Secondary forest		Sabul	c.600 m from previous observation

TABLE 1 (cont.)

Date (MI)	Time	Number	Behaviour	Location	Forest type	Distance	Notes
23/09/06 (YM)	c.10.00 h	1		Sabot			Bird not seen
02/10/06 (MI)	-	-		Momos (01°15'52.5"S, 122°53'09.3"E)	Secondary forest	3	Four unoccupied nests
04/10/06 (MI)	c.10.30 h; 2 minutes	3	1	Pasuyasi (01°17'11.5"S, 122°53'39.3"E)	Secondary forest	4	Group never seen well due to nervous behaviour, but stayed 1 hour, before leaving.
05/10/06 (MI)	06.30–06.35 h; 5 minutes	2	unknown	Bobonggon (01°16'34.3"S, 122°53'47.3"E)		5	
05/10/06 (MI)	07.22 h	-		Bobonggon; c.650 m	Secondary forest		
05/10/06 (MI)	16.00 h	4	unknown	Near Amos (01°16'39.1"S, 122°54'26.2"E)	Primary forest		
05/10/06 (MI)	17.30–17.40 h; 3 minutes	3	unknown	Amos (01°16'28.1"S, 122°53'33.7"E)	Secondary forest		
05/10/06 (MI)	17.40–17.50 h; 1 minute	2	unknown	Amos	Border of cultivation / secondary forest		300 m south of previous group

¹Grid reference nos. 1–5 correspond to Fig. 1. Nos. 6–7 correspond to 01°17'44.14"S, 122°59'18.95"E, and 01°17'42.85"S, 122°59'35.59"E, respectively. Observations at these latter two points were not tabulated because they were made on 1–7 May 2007, i.e. outside the period covered by the table.

Banggai Crow also sounds like that of Piping Crow, although the last note is shorter than that of Piping Crow (IT pers. obs.). The calls of Banggai and Piping Crows differ from those of Slender-billed Crow in both the rest of the Banggai Islands and the nearby mainland, i.e. the southern part of Sulawesi's eastern peninsula, which is a simple caw ending sometimes in a falsetto (Indrawan *et al.* 1997).

The calls of Banggai Crow, especially type 2, are imitated by Hair-crested Drongo *Dicrurus hottentottus*. However, the imitations are usually followed by strophes of typical drongo calls including harsh and high-pitched metallic note(s), and therefore can be separated with care.

Results

Distribution.—The species is well known to local people of western Peleng, who gave it a local name, the onomatopoeic 'Kuyak', and are confident in differentiating its calls from those of Slender-billed Crow, whose vernacular name 'Pak-pak' is also onomatopoeic. They gave a detailed description of its morphology ('smaller-sized crow') and behaviour-ecology ('montane forest bird'), suggested that it is locally abundant, and eventually helped us locate the bird's main haunts. In general, Banggai Crow occurs in forested areas, as well as mosaics of forest and cultivation, but not wholly deforested areas. The species' overall altitudinal range on western Peleng, 500–900 m, corresponds to the lower montane to upper montane forest zones (DSK & MI pers. obs.).

Multiple encounters of birds in groups of up to four, especially at higher altitudes, are presented in Table 1. On the edge of forest at Luk Panenteng (01°13'00.7"S, 122°58'22.6"E; c.15 m), local farmers reported the species two days prior to our visit, but this is unconfirmed. Due to the brevity of our visit to the westernmost mountains, at Alani (7 October 2004), no sightings were made. However, local people are apparently familiar with the species. Slender-billed Crow was encountered mainly up to 400 m (with a single observation of one at c.900 m; cf. Mallo *et al.* 2010). Overall, westernmost Peleng is heavily deforested and it is unlikely that Banggai Crow is abundant there. The central and easternmost part of western Peleng is more forested, including at Luk Panenteng and Alul-Kramat near the south coast. Banggai Crow is well known to many local farmers and hunters there.

Many sightings were obtained at the main study sites in the western part of western Peleng, namely at Laheme and Bobonggon. At Laheme, apparently three different pairs, each with two fledglings, were briefly encountered in forest at c.700–900 m (AM & MI, 5 October 2004). At Bobonggon, along a transect of c.2.6 km, at least 12 birds were detected (5 October 2004). Above Tetendeng village we therefore estimated 32–50 birds within a radius of 3–4 km. A transect of c.4 km on the forested upper montane slope of Kramat-Alul suggested that c.5 groups (of 15–25 birds) may occur.

A branch nester, nests of Banggai Crow were found at three locations (Table 2). Nest trees were tall forest species (c.12–30 m tall) including Bombaceae, *Calophyllum*, *Canarium*, *Palaquium*, and other unidentified trees. Nest trees were either emergents or at least fairly isolated from their neighbours. Frequently, nests were placed on branches facing east. On a given tree 1–7 nests were found. Nests were always clustered in ones or twos, frequently on main stems, and within the topmost two-thirds of the canopy.

Discussion

Relative abundance.—As initially indicated by local information, we found Banggai Crow to be locally abundant, especially in montane western Peleng (Table 1). Observations suggest that Banggai Crow occurs mainly at higher altitudes (500–900 m) with heavy forest

TABLE 2
Nests of Banggai Crow *Corvus unicolor* found in 2006 and 2007.

Date (observer name/s in brackets)	Location	Habitat	Nest tree	Diameter at breast height of nest tree	No. of nests per tree	Nearby nesting tree	Notes
22/09/06 (YM & FM)	Sabol	Primary forest	<i>Palaquium</i> sp.		4	None	Apparently unoccupied nests of varying ages.
02/10/06 06/10/06 09/10/06 (MI)	Momos	Secondary forest	Bombaceae <i>Calophyllum</i>	c.20 cm c.15 cm	3 1	Two trees c.15 m apart	No birds seen at the nests but local people indicated that one was last seen at a nest on 30 September and that one was seen on the same tree after we left. Nest revisited on 6 October (05.30–06.00 h) and 9 October (18.00–19.00 h) but no birds seen. On 6 October, a crow was flushed from the canopy, but no conclusive evidence of nest being active. Direct inspection was not undertaken for fear of disturbance.
02/05/07 (MI)	Alul-Kramat	Primary forest c.700–900 m	<i>Myristica</i> sp. <i>Canarium</i> sp. unidentified	c.25 cm c.15 cm c.20 cm	5 1 2	None Two trees only c.7 m apart	Apparently unoccupied nests of varying ages.
02/05/07 (MI)			unidentified	c.40 cm	7		Apparently unoccupied nests of varying ages.
02/05/07 (SK)			unidentified		1		Emergent tree.
02/05/07 (MI)	Kramat (near summit)	Primary forest c.800 m	unidentified	c.25 cm	2	None	Apparently unoccupied nests of varying ages; emergent tree.
15/05/07 17/05/07 (YM & FM)	Amos	Secondary forest	unidentified	10 cm 15 cm	1 6	Two trees c.500 m apart	Active nest tended by 2 birds, with 1 egg. Active nest tended by 1 bird, with 3 eggs.
29/06/07 (via AM)	Buta Banggong	unknown	unidentified	-	-		Active nest, with 3 eggs.

cover, which, except for a previous three-day visit by YM & LP (Indrawan *et al.* 1997), have been little explored hitherto. On western Peleng, Banggai Crow is not common in the lowlands (although CBC found otherwise in the central isthmus). Based on previous surveys, including an archipelago-wide search in 1991 (Indrawan *et al.* 1993, 1997), it is unlikely that the species occurs in any numbers elsewhere on the Banggai group's larger islands, or even away from montane western Peleng and the central isthmus, meaning that it has a very small range (Indrawan *et al.* 1997, Indrawan & Masala 2007, CBC 2008, Mallo *et al.* 2010).

Local hunters on western Peleng estimated up to 50 birds in a 3–4-km radius. However, care must be taken in extrapolating local densities across the species' available altitudinal range and habitat, because not all montane habitats support the crow. Based on our

observations and local reports, we estimated that in the western Peleng Mountains Banggai Crow numbers 50–200 individuals, and YM estimated there may be close to 500 birds throughout western Peleng.

While the crow nests in tall trees, at risk of clearance, we encouragingly observed relatively frequent fledglings and juveniles in 2004, 2006 and 2007, indicating active recruitment.

Breeding biology.—Mostly unoccupied (probably abandoned) nests were observed in September–October 2006 and April–May 2007 (Table 2). The crow apparently nests at least once p.a., during and / or at the end of the wet season, i.e. during our 2006 and 2007 surveys in August–September and in May–June, respectively. Despite that *Lithocarpus* spp. are among the locally dominant trees, their use for nesting was not seen by us, but a local person informed us that he had seen them being used once or twice (A. Lumano pers. comm.). It is unknown why these trees are not habitually used; perhaps their architecture or ant commensalism discouraged their use by Banggai Crows for nesting.

The number of nests probably depends on the size of the nesting tree. Nests were of different ages. Based on the colour and relative decay of the dried sticks, the older nests appeared darker whereas recently constructed nests are whitish. It is unknown if different nests on the same tree were used simultaneously, but based on the age of the sticks used it seems more likely that they were consecutively constructed in different seasons. Furthermore, the closest nest trees were usually 100–200 m apart, suggesting the species is probably not a colonial nester.

Nests were constructed of relatively sparse dry sticks and branches, in slightly depressed platforms or, occasionally, in the shape of a slightly inverted cone. The inner cup was more neatly lined with finer branches and twigs. The nest's form resembles that of Slender-billed Crow in the Banggai group (MI & YM pers. obs.), but the latter's nests are larger, and constructed of larger sticks. Nests of Banggai Crow resemble those of Green Imperial Pigeon *Ducula aenea* in size (but the latter is a platform of much sparser and thinner branches), whereas nests of Slender-billed Crow are as large as those of Brahminy Kite *Haliastur indus* but less cup-shaped than the latter (YM & MI pers. obs.).

A local farmer in Alani reported finding a nest in a 'Kayu Tomoni' tree (scientific name unknown) which contained a single nestling (July 2004). A local report was also received of a nest with three eggs on 29 June 2007, at Buta Banggong (A. Maleso pers. comm.).

Two active nests c.0.5 km apart were observed on 15 and 17 May 2007, at Amos (YM & FM). At the first, a bird was seen on the nest warily observing its surroundings. Its partner perched nearby, c.10 m away. During the 20-minute observation, the birds were almost silent, with the non-brooding individual calling just once. The second active nest was on a tree with six nests on it. When approached, a single Banggai Crow silently made circular flights twice around the nest, then left. Five minutes later a call was heard nearby. The two nests held one and three eggs, respectively, which were white, fairly heavily marked with faint purple to grey spots, and sparse bold speckles of brown.

Detecting the species would probably be easier in July–September (post-wet season) when fledglings are barely able to fly and effectively restrict the movements of the adults. *C. unicolor*, like many other crows, is gregarious and apparently travels in family parties. In October 2004 and September–October 2006, juveniles were still with the adults. During one observation, on 4 October 2004, a fledgling was fed arthropods (Sunosol pers. obs.).

Ecology.—The apparently regular distribution of Banggai Crow indicates that the species maintains group territories. However, our observations reveal that birds regularly descend the slopes and cover large areas, suggesting that their home range may be extensive. Like

most passerines, Banggai Crow is active during the early morning and late afternoon. Calls were heard just after sunrise, and two birds were seen in the canopy of tall isolated roost trees at a *ladang* abutting forest edge, at c.900 m (MI, 5 October 2004). Early morning is sometimes used for prolonged sunning and preening on bare branches (MI pers. obs.). In mid to late morning, the birds move in threes and fours from the roost areas to the forested lower slopes, to forage (MI pers. obs.). In the afternoon they gradually approach the roost sites in loose family parties, with more calling. When foraging, the crow frequently keeps to the upper canopy, whereas in the midday hours they stay in the mid canopy. Trees that are frequently used are those with some leaves. It roosts in emergents and tall trees in the forest and forest edge. The birds appear less inclined to cross wide open areas, especially compared to Slender-billed Crow. On the infrequent occasions that crows were observed flying above the canopy to cover longer distances, they followed valley contours.

In the absence of farmers, *C. unicolor* may forage in *ladang* dry-land cultivation and perch just 1–3 m above ground (MI pers. obs.). However, in places where inhabitants use airguns, e.g. Kokolomboi, the crow did not appear 'habituated' and spent even less time on individual perches. At Bobonggon, where airguns are rare, they appeared to spend longer perched. At both sites, the local community attributed difficulties in making prolonged observations to the crow's intelligence and wariness (B. Maddus pers. comm.).

It is sometimes possible to follow birds while foraging. At the forest edge in the subvillage of Kokolomboi, at c.500 m, one bird was encountered repeatedly at the same location. In another observation, a family of three, actively foraging and fluttering between trees appeared to remain in the same area for at least one hour in late morning.

Given the relative scarcity of fruits, we hypothesise that the main food of Banggai Crow is probably arthropods, which may also explain its relatively smaller size. Local hunters report that the bird takes winged isopteran termites.

Our general observations of behaviour, especially the whistled call, and preference for forested canopies, nervousness, as well as observer-mobbing suggest that the species is more closely related to *C. typicus* than to *C. enca* (see Mallo *et al.* 2010).

Our data support BirdLife International's (2001) assessment that Slender-billed Crow has become dominant in more disturbed habitats, especially in the lowlands. The highest recorded altitude of *C. enca*, 400 m at Alani, appears to lie below that of Banggai Crow, and they may be altitudinally segregated. It is unknown, however, how much lower Banggai Crow ranged in prior decades. On western Peleng, Banggai Crow is reported to have occurred near sea level c.40 years ago (AM pers. obs.).

Threats.—Conversion of montane forest to meet the demand for agricultural land for the increasing human population constitutes one of the main threats to the species. Forest conversion to shifting cultivation is a potential threat because conversion will reduce available habitat for the Banggai Crow, but will also pave the way for Slender-billed Crow to extend its range. Although subsistence hunting occurs, and airguns are increasingly used, there is no systematic demand on the crow. Some farmers believe the crow is a minor pest because it is assumed to take poultry eggs. However, this seems very unlikely, given the crow's range, which calls for clarification of the crow's behaviour.

Conservation.—The status of Banggai Crow was re-evaluated using data from our surveys. Based on known records and projected range within suitable habitat, the species has an estimated Extent of Occurrence (EOO) of c.494 and 209 km² in the west of the island and central isthmus, respectively. The area, extent and quality of habitat within this range is declining meaning the species is Endangered under criterion B1a+b(iii) (i.e. an EOO of <5,000 km² at a single location and declining). The survey also projected that the area,

extent and quality of habitat are likely to decrease even further due to conversion and over-exploitation of resources. Because altitudinal range expansion by Slender-billed Crow could pose a direct threat to Banggai Crow, *in situ* conservation of the latter should include monitoring of Slender-billed Crow as a potential competitor

Our limited interviews suggested that local community members could feel pride in the unique existence of Banggai Crow in their regions. Although the crow is considered a minor pest, several local farmers are interested in its conservation. Thus conservation measures should be designed as bottom-up processes beginning with local farmers (and hunters). Use of the vernacular name 'Kuyak' may instill local pride, and assist conservation efforts. To develop local awareness, local people should be involved in research, including into the crow's diet, in order to establish that it is not an egg predator.

Habitat protection is of high priority. Reserves should be developed in conjunction with community-based forest protection, but are possible only through agreements between regional (=district) government and local communities concerning land use. It is more rational to realise community agreement, through traditional 'adat' laws, before establishing regional regulations to protect the forests.

In the long run, ecotourism could contribute to the economic value of the species and its habitat. However, birdwatchers must be sensitive to local culture, especially as the crow's main range is surrounded by isolated communities whose members do not necessarily speak the national language. For instance, in our experience, even casual birdwatching can give rise to conflict, which could be counterproductive to the species' conservation. It is recommended that visits include not only birdwatching but also work with local stakeholders to ensure two-way communication and effective sharing of benefits, whether material, knowledge, or beyond.

Acknowledgements

The surveys in 2004–07 were funded by Nagao–Natural Environmental Funding (NEF), British Birds, and Zoologische Gesellschaft für Arten- und Populationsschutz e. V. (ZGAP). We thank Prof. Somadikarta (Univ. of Indonesia) for sharing his vast knowledge of historical Indonesian ornithology. Dr Roland Wirth and Prof. Stephen Garnett encouraged a wider focus for this study. Dr Paul Sweet (AMNH), kindly provided information on the syntypes. Jon Riley (OBC), Dr Nigel Collar (BirdLife International), Dr Paul Donald (RSPB), Guy Kirwan, Jeremy Bird and Murray Bruce made expert comments on an earlier draft. Prof. Pamela Rasmussen kindly provided her expert advice on crow taxonomy. The people of Tetendeng have always encouraged us to learn from their expertise of local natural history. For guidance and sharing knowledge in the field, we thank Aliman Lumano, Ardi See, Bisalung Maddus and Hepson Laaso. We thank Ms. Herlina (Celebes Bird Club) for information exchange in Palu.

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